

REMARKS

Claim 1 has been amended, claims 28-33 have been canceled, and claims 34 and 35 have been added. Accordingly, claims 1-5, 7-12, 14-16, 34, and 35 are currently pending in the case. Further examination and reconsideration of the presently claimed application are respectfully requested.

Election/Restrictions

Claims 28-33 were withdrawn from consideration as being directed to a non-elected invention. In response to the Examiner's restriction requirement, claims 28-33 have been canceled. The Applicant, however, reserves the right to file a divisional application at a later date to capture the subject matter recited in non-elected claims 28-33.

Section 103 Rejections

Claims 1-5, 7-12 and 14-16 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,337,285 to Ko (hereinafter referred to as "Ko '285") in view of U.S. Patent No. 6,117,791 to Ko et al. (hereinafter referred to as "Ko '791"). Claims 1-5, 7, 8 and 10-14 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,025,255 to Chen et al. (hereinafter referred to as "Chen") in view of U.S. Patent No. 5,631,179 to Sung et al. (hereinafter referred to as "Sung") and U.S. Patent No. 5,314,575 to Yanagida (hereinafter referred to as "Yanagida"). Claims 9, 15 and 16 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Chen in view of Sung, Yanagida and Ko '791. To establish a *prima facie* obviousness of a claimed invention, all claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974), MPEP 2143.03. Obviousness cannot be established by combining or modifying the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion or incentive to do so. *In re Bond*, 910 F.2d 81, 834, 15 USPQ2d 1566, 1568 (Fed. Cir. 1990). The cited art does not teach or suggest all limitations of the currently pending claims, some distinctive limitations of which are set forth in more detail below.

None of the cited art teaches or suggests changing gases supplied to an etch chamber between two distinct etch steps of a dielectric layer such that gases of an etch chemistry used for the first etch step are present in negligible quantities during the second etch step. Amended claim 1 recites, in part:

A method for forming a semiconductor device, comprising: etching a first portion of a dielectric layer formed on a semiconductor topography with a first etch chemistry ... etching a second portion of the dielectric layer with a second etch chemistry different from the first etch chemistry ... and changing gases supplied to an etch chamber comprising the semiconductor topography between the steps of etching from those producing the first etch chemistry to those producing the second etch chemistry such that gases of the first etch chemistry are present in negligible quantities during the step of etching the second portion of the dielectric layer.

Support for such a limitation may be found, for example, on page 11, lines 12-17, of the Specification:

The first etch chemistry may be substantially different than the second etch chemistry. For example, after etching the first portion of the dielectric layer for a period of time, the gases supplied to the etch chamber may be changed from those producing the first etch chemistry to those producing the second etch chemistry. As such, gases of the first etch chemistry may be present in the etch chamber in negligible quantities after the etch chemistry is changed from the first etch chemistry to the second etch chemistry.

Neither Ko '285, Ko '791, Chen, Sung, nor Yanagida discuss changing gases supplied to an etch chamber between two distinct etch steps of a dielectric layer such that gases of an etch chemistry used for the first etch step are present in negligible quantities during the second etch step. In fact, Chen specifically teaches away from such a method by using the same gases for the first and second etch steps described therein, differentiating the steps by different flow rates of the same gases. In particular, Chen teaches "The flow rates of the etchant gases are now altered to reduce the steady state thickness of polymer over the nitride surfaces and the second etch step is begun. This is accomplished by lowering the flow rate of C_4F_8 by about 10% and lowering the flow rate of CH_3F by about 30%." (Chen, column 6, lines 9-13). Ko '791 and Sung do not even teach etching a dielectric layer with two different etch chemistries. Consequently, Ko '791 and Sung do not teach or suggest changing gases supplied to an etch chamber during the etch process of a dielectric layer.

Although Yanagida does teach etching silicon compound film 1 with two different etch chemistries, Yanagida fails to teach or suggest that the gases of the first etch chemistry are substantially purged from the etch chamber prior to etching silicon compound film 1 with the second etch chemistry. Similarly, Ko '285 fails to teach or suggest that the gases of the first etch chemistry are substantially

purged from the etch chamber prior to etching oxide layer 24 with the second etch chemistry. To establish a *prima facie* obviousness of a claimed invention, all claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974), MPEP 2143.03. In addition, without any teaching or suggestion to purge the gases of the first etch chemistry from the chamber prior to etching the topography with the second etch chemistry, there is no motivation within Yanagida or Ko '285 to teach the limitations of claim 1. The lack of motivation to teach the limitations of claim 1 is particularly noted in Ko '285 in that similar components may be used for both the first and second etch chemistries in some cases. As noted in the Office Action, Ko '285 teaches that CH_2F_2 may be added to the C_4F_8 etch chemistry used to etch oxide layer 24 during the first etch process. Ko '285 further teaches in column 6, lines 44-57 that the second etch chemistry preferably includes CH_2F_2 . Since the first and second etch chemistries may include similar gases and there is no teaching or suggestion in Ko '285 of purging the gases of the first etch chemistry from the etch chamber prior to etching the topography with the second etch chemistry, there is no motivation to evacuate the etch chamber of gases from the first etch chemistry prior to the second etch process.

As noted below, the limitation in claim 1 specifying that the second etch chemistry has a dielectric material:silicon oxide selectivity of at least approximately 5:1 is not taught or suggested by the cited art. However, in order to expedite prosecution, claim 1 has been amended to include the limitation noted above of changing gases supplied to the etch chamber between the steps of etching such that gases for the first etch chemistry are present in negligible quantities during for the second etch step. As set forth above, such a limitation further distinguishes the presently claimed case over the cited art and, therefore, claim 1 is asserted to be patentably distinct over the cited art.

None of the cited art teaches or suggests etching a second portion of a dielectric layer within an etch chemistry having a dielectric material:silicon oxide selectivity of at least approximately 5:1, wherein the dielectric layer comprises the dielectric material. Claim 1 recites in part: "A method for forming a semiconductor device, comprising ... etching a second portion of the dielectric layer with a second etch chemistry ... wherein the second etch chemistry has a dielectric material:silicon oxide selectivity of at least approximately 5:1, and wherein the dielectric layer comprises the dielectric material" As noted in the Office Action, none of the cited art discloses etch chemistries having specific selectivities between a dielectric material being etched and silicon oxide. To establish a *prima facie* obviousness of a claimed invention, all claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974), MPEP 2143.03.

The Office Action states that ranges of etch selectivity are considered to involve routine optimization. Such a statement, however, is traversed. The etch selectivity limitation of claim 1 is specific to the composition of the chemistry of the second etch process. As noted on page 30, lines 8-12:

... the second etch chemistry may include hydrofluorocarbons such as $C_2H_2F_4$ and CHF_3 . In addition, the second etch chemistry may include an inert gas such as argon or xenon. Furthermore, the second etch chemistry may include a number of additional fluorinated carbon compounds and/or chlorinated carbon compounds such as $CFCl_3$, CF_2Cl_2 , CF_3Cl , CF_4 , C_2F_6 , and C_2ClF_5 .

As such, the second etch chemistry may include specific combinations of such compounds in order to obtain a dielectric material:silicon oxide etch selectivity of at least 5:1. In addition, the second etch chemistry may be characterized by its ratio of components. The presently claimed case outlines such ratios by specifying the flow rates of exemplary components on page 31, lines 1-7 of the Specification. Without any teaching or suggestion of etch chemistries which may include all of compounds and ratios of compounds described in the presently claimed case, it is asserted that it would not be obvious to one skilled in the art to create an etch chemistry having a dielectric material:silicon oxide selectivity of at least approximately 5:1 by routine optimization.

As such, although Ko '285 mentions that the etch chemistry for the second plasma etch step described therein has a high selectivity to undoped silicon oxide, it would not be obvious to one skilled in the art to create an etch chemistry by routine optimization to have a selectivity of at least approximately 5:1 without teaching all of compounds and ratios of compounds described in the presently claimed case. Ko '285 does not teach all of the compounds and ratio of compounds described in the presently claimed case. In particular, Ko '285 fails to teach the inclusion of $C_2H_2F_4$, $CFCl_3$, CF_2Cl_2 , CF_3Cl , C_2F_6 and C_2ClF_5 in the etch chemistry used for the second plasma etch step described therein. In addition, Ko '285 fails to teach the exemplary flow rates of $C_2H_2F_4$ noted on page 31, lines 2-3 of the Specification for the second plasma etch chemistry described therein.

The aforementioned arguments regarding the limitation of the second etch chemistry having a dielectric material:silicon oxide selectivity of at least approximately 5:1 were included in a response to a previous Office Action mailed June 4, 2003. The Final Office Action mailed October 10, 2003, however, states that such arguments are not persuasive because the "Applicant does not claim the selectivity between the dielectric material being etched and an underlying layer of silicon oxide." Such a basis for rejection is traversed, however, since claim 1 does indeed include the limitation of dielectric material:silicon oxide

selectivity as noted above. Such a selectivity is a limitation of the second etch chemistry and, therefore, the arrangement of the topography (i.e., that the dielectric material is arranged above an underlying layer of silicon oxide) does not necessarily have to be recited with the claim.

For at least the reasons set forth above, none of the cited art, either individually or in combination, teaches, suggests, or provides motivation for all limitations of independent claim 1. Therefore, claim 1 and claims dependent therefrom are patentably distinct over the cited art. Accordingly, Applicants respectfully removal of this rejection.

Patentability of the Added Claims

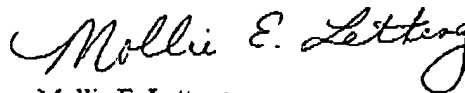
The present Amendment adds claims 34 and 35 which are dependent upon claim 1. Therefore, claims 34 and 35 are patentably distinct over the cited art for at least the same reasons as claim 1. Accordingly, approval of added claims 34 and 35 is respectfully requested.

CONCLUSION

This response constitutes a complete response to all issues raised in the final Office Action mailed October 31, 2003. In view of the remarks traversing the rejections presented therein, Applicants assert that pending claims 1-5, 7-12, 14-16, 34, and 35 are in condition for allowance. If the Examiner has any questions, comments, or suggestions, the undersigned earnestly requests a telephone conference.

No fees are required for filing this amendment; however, the Commissioner is authorized to charge any additional fees, which may be required, or credit any overpayment, to Conley Rose, P.C. Deposit Account No. 03-2769/5298-04100.

Respectfully submitted,



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